2002 Energy Efficiency Program Selection R. 01-08-028

Energy Efficiency Proposal For a Study of Residential Metering and Management System

US Power, Inc

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Proposal for:
Intelligent Metering and Energy Management System

1 Introduction

U.S. Power is pleased to submit this proposal to conduct a study, which will quantify the potential energy savings, which is achieved by implementing a system with the following characteristics:

- Energy meter where the energy measurement device and display are separate and distinct.
- Remote control of, service-connect and service-disconnect.
- Remote disconnecting of non essential load
- Automatic meter reading (AMR)
- Energy Consumption budgeting
- Two way data communications between the utility and consumer
- Time Of Use (TOU) metering or multi-tariff metering
- Smart load control, smart load shedding, and smart load management
- Power theft detection
- Outage detection
- Provision for sub-metering in multi-tenant buildings
- Open communications environment, which enable open access down to residential loads
- Additional value added services, such as prepayment metering, critical temperature monitoring, earthquake service disconnect, etc.
- Surge protection
- Consumer consumption planning and budgeting

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1.1 Program Description and Objectives

Although the Intelligent Metering Technology Framework (IMTF) was developed in the US by US Power, the first implementations occurred in South Africa by IMS to address the needs of a huge electrification program mandated by the South African Government, principally targeted at low income housing. While the social economic situation in South Africa is substantially different to that of the US, the functionality of the IMS technology framework can solve non payment and theft of power on one hand, while addressing energy efficiency and load management on the other.

Originally the user – mainly municipal utilities and Investor Owned Utilities (IOU), relied on manual meter readings and in instances where the meter could not be read, estimated readings. These readings were used to generate energy bills, which were then posted to the consumers and eventually paid by the consumer. This cycle normally takes approximately three months from the time the energy is supplied until the time the bills are paid. Also, due to the manual processes the expenses for such services were extremely high.

It was obvious that this state of affairs could not be allowed to continue and that a better solution was needed. The first step in this direction was the introduction of short-range radios on the meters, which were then read by a drive-by radio receiver and the readings supplied to the financial department for billing in the normal way. This improved efficiency and reduced costs but it was obvious that this was only a small step towards a complete solution.

Thereafter the automatic meter reading was introduced where meters were read electronically via radio and the readings downloaded to the financial system automatically. The rest of the processes were again as before. This further increased efficiency and reduced costs. The next step was the introduction of the prepayment system by Utilities in the late 1980's, which had some limited successes but failed to resolve all the problems in low income housing in particular those who were unable to budget their consumption of utilities.

U.S. Power conducted a world-wide study of utility markets including utilities in the United States, Europe and the Far East. Consequently, U.S. Power gained excellent knowledge of customer requirements within the different utilities. Whilst many of these requirements are common, on many occasions customers have additional requirements for their particular needs. The next generation system includes all the functionality of the first generation system and addresses further utility requirements meeting their different needs, some of which are listed but are not limited to the following:

- The new system addresses the need for residential, commercial and industrial consumers – i.e. a “one stop solution” for all metering solutions.
- Smart load management
- Smart energy management facilities.
- Outage management
- Energy loss detection – Power Theft, Faulty network / equipment
- Service connect / disconnect
- Flexible payment methods – Traditional or prepayment:
- Consumer budgeting assistance
- The system is data base independent and is designed for ease of maintenance, either locally or remotely to allow the customers to use their legacy systems and have access to professional resources from outside.
- The system has financial and technical reports for management on a daily basis so that management can take the appropriate action at a very early stage to improve efficiency, revenue collection and thereafter, profitability.
- The system makes provision for customers to have access to all relevant information regarding their energy management to enable them to introduce systems to control their energy use and therefore improve their own efficiency and profitability.
- The system is designed to accommodate other requirements by the customer such as time of use tariffs, site management purchases of energy over the internet and planning, and other requirements as may become evident in the future.

While conducting this study, U.S. Power realized that there was no system that can achieve the functionality mentioned above. Utilities worldwide have been demanding that a system of this type be made available on the market but for many reasons, both technical and commercial, none existed.

U.S. Power proposes to conduct a study to identify potential energy savings when using a system developed around the Intelligent Metering Technology Framework (IMTF). IMS has demonstrated that their system, which is based on IMTF, produced energy savings of >13%, reduced energy demand significantly, while improving both revenue and cash flow. This program will interview both utilities and consumers in order to identify and prioritize opportunities for improving energy efficiency.

1.2 Innovation

This study will use a holistic approach to solving the energy efficiency needs of the CPUC. Unlike a purely marketing program, this study proposes to identify a solution that will educate both utilities and consumers, provide them with tools to manage their consumption and demand, and ensure that both the consumer and utilities are fully informed to make decisions which will ultimately be for their mutual benefit.

2 Program Overview

U.S. Power will identify targeted utilities and customers. In-house engineers form the primary team that conducts the study. Also, a pool of independent consultants, who offer specialized energy audit services related to Intelligent Metering and load management, are used to provide more detailed analyses.

2.1 Description and Objectives

U.S. Power plans to conduct twenty preliminary technical studies of Utilities and consumers utilizing U.S. Power engineers. Thirty additional studies utilizing the services of outside consultants is planned.

a) Long-Term Annual Energy (Gas and Electric) Savings

There is no estimate of energy, capacity, therm saving, or cost effectiveness for this program. Although it is the intention of each energy efficiency program to encourage the efficient utilization of electricity and/or gas, the calculations performed for the 2002 program cost-effectiveness utilize energy, capacity, and therm savings estimates for measure and programs for which there is a lower degree

of speculation. The lack of energy savings, capacity savings, therm savings, resource benefits, or a TRC ration for any particular program (i.e. information program) should not imply that a measure or program does not promote energy efficiency nor should it imply that there is not an impact to the consumer's use of electricity or natural gas or a corresponding impact to the electricity or natural gas system. However, pursuant to the Commission's approved Energy Efficiency Policy Manual (Policy Manual), this proposal for an information-only program is not reasonably expected to provide an estimate of energy savings.

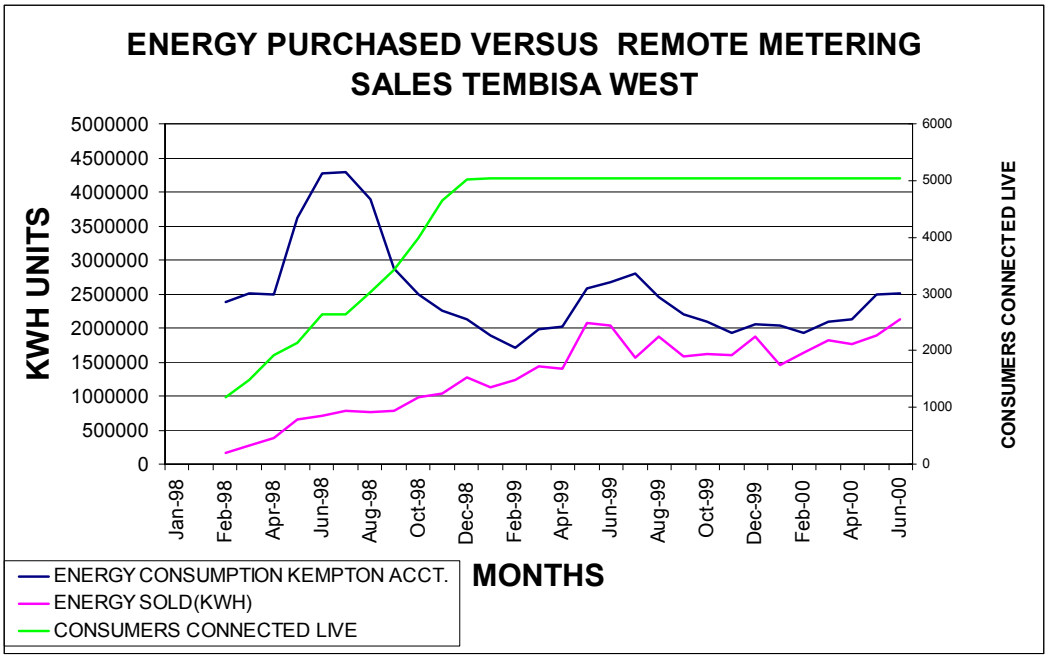

Figure 1 Graph showing effectiveness of IMS system

Figure 1, above depicts results from a typical installation of IMS system in South Africa.

b) Cost Effectiveness

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c) Equity Considerations

The study will include hard-to-reach markets. It has been our experience that such markets often feel that they are being exploited (and some times they are!) and have a major distrust for any system installed to control and manage their load and provide billing. Our study will identify the specific concerns and solutions required by utility, landlord and tenant to educate all parties, provide for auditing functions to ensure correct billing practice and to generally ensure that the level of service and trust is assured.

The proposed study will identify a solution that will benefit all clients equally.

d) Electric Peak Demand Savings

There is no estimate of Peak Demand Savings for this program. Although it is the intention of each energy efficiency program to encourage the efficient utilization of electricity and/or gas, the calculations performed for the 2002 program cost-effectiveness utilize energy, capacity, and therm savings estimates for measure and programs for which there is a lower degree of speculation. The lack of Peak Demand Savings for any particular program (i.e. information program) should not imply that a measure or program does not promote Peak Demand Savings nor should it imply that there is not an impact to the consumer's use of electricity or natural gas or a corresponding impact to the electricity or natural gas system. However, pursuant to the Commission's approved Energy Efficiency Policy

Manual (Policy Manual), this proposal for an information-only program is not reasonably expected to provide an estimate of energy savings. What is important here is that the IMTF defines a system that will enable the utility to identify loads in real-time, and then schedule the disconnection of non-essential loads in a predefined sequence to ensure network stability.

e) Innovation

What is unique about the IMTF is that it addresses several areas in one solution. We have taken a more holistic approach and have made use of economy of scale to enable a cost effective and flexible solution to meet the growing demands of the industry.

The IMS system in one system provides for:

- Remote Metering
- Sub Metering
- Billing
- Consumer budgeting assistance
- Energy auditing and balancing
- Load balancing
- Remote connect/disconnect facility
- Smart Load Management
- Open scalable system that can interoperate with other vendors
- Outage detection
- Time Of Use (TOU) or Multi Tariff metering
- And other features identified in the future

f) Synergies and Coordination with Programs Run by other Entities

IMS enables open access all the way down to the residential consumer. The issue of who owns the infrastructure will no longer be an impediment to installing a system such as IMS, since the IMS system can service any number of utilities/energy providers and all the consumers.

As mentioned previously, the IMS system also integrates all other saving programs and equipment into one homogenous efficient system. Integration with organizations that carry out home “appliance efficiency analysis” consulting will be proposed. The study will also propose the integration of plants to generate hydrogen (used in fuel cells) and biomass carbon fuel (used by biomass generator) during non peak periods to flatten the load curve.

The budget for this program is $902,000.00. The target market segments are single family residential customers within areas

2.2 Target Market Segments

For purposes of this proposal we intend targeting a cross section of residential consumers. It is important to include a suitable cross section of consumer base, in large enough numbers, in order not to taint the actual results with desired results.

The IMTF solution targets all the consumers of energy across the board which includes residential, residential hard to reach, large and medium industrial and commercial, small industrial and commercial and very small industrial and commercial.

2.3 Barriers

From experience, one of the greatest market barriers to lack of success in energy efficiency drives amongst consumers, is lack of education and information. Energy providers on the other hand often lack detailed information as well as methods to manage and control their loads.

Most power utilities are extremely conservative and reluctant to change. To conduct a successful study will require the utilities to think outside the box. This tends to be difficult for some utilities, but not impossible. The process of market deregulation tends to create confusion, and hence more reluctance by the utilities to entertain change until it is thrust upon them

By educating consumers (residential, commercial, industrial, agricultural, etc) and providing incentives, consumers will modify their behavior to be as efficient as possible. Present day consumers tend to view the energy bill as a fixed expense, with the IMS system they will soon see that they

have many opportunities to implement saving schemes and predict what their consumption will be – a major incentive in itself. Very few consumers will knowingly waste energy, but due to lack of information most are not even aware of their wasteful habits. In other words, the premise is an informed consumer will always be more energy efficient than an uninformed consumer. Another way of articulating this problem is that a consumer cannot control what they are unable to measure. For example, if a consumer is provided a display that predicted their next billing based on their historical load profile, studies have shown that the consumer will adjust their current consumption patterns to match their budget. This could apply equally to corporations attempting to manage their costs, as well as low income homes living on a tight budget. Another benefit is the comparison to the average consumption of similarly sized premises. This will enable consumers to do benchmark comparisons to other comparable consumers (base lining). When consumers learn that their appliances are much less efficient than available high efficiency devices, they can calculate the potential savings, and hence determine their rate of return (ROI) should they upgrade to more efficient appliances.

3 Program process

3.1 Program Enrollment

U.S. Power will identify targeted utilities and customers. In-house engineers form the primary team that conducts the study. Also, a pool of independent consultants, who offer specialized energy audit services related to Intelligent Metering and load management, are used to provide more detailed analyses.

3.2 Marketing and Outreach plans

U.S. Power plans to conduct 20 preliminary technical studies of Utilities and consumers utilizing U.S. Power engineers. Thirty additional studies utilizing the services of outside consultants is planned.

3.3 Procedures for equipment purchase or installation

Not Applicable

3.4 Processes for payment of incentives to customers

Not Applicable.

4 Customer Eligibility

In order to conduct a complete and successful evaluation we would need to target various consumers from a cross segment of the population. The IMTF does not distinguish between income levels or ethnic populations. Rather it is a tool that can be configured to best implement the desired system operation.

For any system to be a success it also needs to be accepted and trusted by suppliers and consumers alike. One of the aims of the study is to determine from a cross segment of consumers and suppliers alike their reaction, needs, wants and concerns regarding energy management systems and schemes. This will allow us to tailor our approach and draw up a recommended strategy outlining the required operation of the solution compliant with the IMTF and service company entities for implementation in the broader field.

From research conducted to date, there is a major need for sub-metering functions to enable landlords/building owners to individually bill their tenants.

5 Cost-Effectiveness Calculations

A solution based on IMTF will control and manage energy usage, which will extend the present plant capacity to meet the future requirements for the next 10 years or more at a fraction of the cost of a new plant.

The system will also optimize energy savings within the clients' premises. It will recover some of the energy losses and will certainly recover any energy theft. By early detection of outages, the system will reduce the time of such outages which will benefit the consumers and utilities alike. The utilities stand to gain as any outage time is a major loss in revenue for them, not to mention the inconvenience to both parties.

On a similar system that is installed in Nelspruit municipality in South Africa, Intelligent Metering Systems has calculated a savings of 13.7% in

revenue. As the two models are similar and there are additional features that can be implemented we expect a savings of at least this amount.

5.1 Summary

From past experiences the IMS system has brought about tremendous savings in areas where installed in South Africa. The system itself is extremely flexible and the purpose of the study is to tailor a specific plan to meet the needs of the energy market in a modern day deregulated environment, as well as lay the ground work for future successes in the energy industry.

6 Program Performance Goals

The Commission Energy Efficiency Policy Manual does not include a payment holdback provision for information programs. Information programs fall under a two-stage payment schedule contingent upon an acceptable program implementation plan and quarterly report submission. Thus, there is no performance goals required for these types of programs.

7 Evaluation, Measurement and Verification Plans

As stated previously in this document, similar systems to the one proposed have already been installed and commissioned and excellent savings have been achieved. Evaluation measurement and verification of the study can only be evaluated when the pilot system has been installed and commissioned. Nevertheless, the achievement and the estimated savings which will result in certain measurable savings, can be judged and evaluated on a table study.

8 Budget

It is estimated that each interview will last 4 hours and each engineer is billed at a cost of $300 per hour fully loaded. Outside consultants to include Auditor, Economic Analyst, Quality Control Manager, Accounting Controller functions.

Item	Description	Hours	Qty	Unit Cost	Cost
1	Utility Interviews	4	20.00	300.00	24,000.00
2	Consultant Interviews	4	30.00	300.00	36,000.00
3	Consumer Interviews	4	50.00	300.00	60,000.00
4	Preliminary Report	1	1.00	75,000.00	75,000.00
5	Review Process	8	1.00	300.00	2,400.00
6	Final Report	1	1.00	75,000.00	75,000.00
7	Travel	2	100.00	1,000.00	200,000.00
8	Outside Consultants				429,600.00
Total Cost					$902,000.00

Table 1 Study Project Budget

9 Description of Implementer's Qualifications

9.1 Company History and Background

U.S. Power and IMS are members of the Thermphase group of companies. U.S. Power instituted Intelligent Metering Technology Framework. U.S. Power has a wide range of experience in the electrical and electronic fields covering communication, energy measurement and load control, which provided the basis for IMS to provide total system solutions to meet the most stringent customer requirements.

Because the Group's employees have kept abreast of state-of-the-art technology, we have accumulated vast experience over the past 20 years in both hardware and software developments. This has enabled us to provide effective and reliable solutions.

When the massive electrification program was implemented in South Africa some eight years ago, we decided to enter the field of electricity metering to design and produce a prepayment system for the local market. Due to a lack of in-house technology we joined forces with Landis and Gyr and their local agent, Ash Brothers. A new company, Ash Electronic Industries was formed and this venture provided the local market with the best prepayment meter available. The brand name chosen for the meter was "Budgy" and several models were introduced to meet the changing specifications of the utilities.

Intelligent Metering Systems (IMS) was formed from the consolidation of two Thermphase companies, namely Ash Electronic Industries and Andronics (a technology solutions provider).

Following international trends in metering, IMS took a strategic decision to enter the overseas market and invest in further development of the next generation meters for utilities.

Our efforts proved successful when a local utility, Kempton Park/Tembisa Metropolitan Substructure awarded us the largest Intelligent Metering project worldwide. The value of this contract today is over R55, 000,000.

The project was completed in 1998 and has proven to be successful and acceptable to both the utility and the local consumers. Please refer to the following graph and award.

This latest development has put our company in the unique position of being the only suppliers worldwide of both conventional stand-alone meters and a remote metering system.

Our intention is to further develop the product line and service other large utilities together with strategic alliances / distribution partners around the world.

The largest site deploying the IMS technology is the Utility Management project at the Kempton Park / Tembisa Metropolitan Substructure. Based on the success of this project, it was extended into adjacent areas.

a) Past project and successes

Past Projects	Description	Consumers
Kempton Park Municipality	Supply, installation & commissioning of a Remote Prepayment Electricity System	45,000
Lethabong Council	Supply, installation & commissioning of a Remote Prepayment Electricity System	10,000
Johannesburg Metro Electricity	Supply, installation & commissioning of a Remote Prepayment Electricity System	1,500
Messina	Supply, installation & commissioning of a Remote Prepayment Electricity System	450

b) Present and Future Projects

Present/Future Projects	Description	Consumers
ESKOM (SOWETO ONLY)	Expecting order for test site ± 5000 consumers	130 000
PORT ELIZABETH	Submitted Tender	200 000
ALBERTON	Tender submitted for ± 1000 consumers	10 000
MESSINA	Test site completed, go ahead with rest of site on council approval	10 000
JOHANNESBURG	Further discussions for additional area 2-3 months	50 000
WITBANK AREA	Discussion and presentation 1-2 months	50 000
NELSPRUIT	Awarded Nelspruit contract	10 000
PRETORIA	Submitted proposal for test site – waiting for council decision	200 000
KOSH (KLERKSDORP)	Council resolution taken to implement IMS system	93 000

c) Personnel resumes or description of relevant experience

IMS employs technically qualified personnel to conduct its research and development activities. The R & D project management team consists of the following personnel:

Name	Qualification	Years Experience
Colin Bester	BSc (Hon) Eng (Elec) Pr.Eng	16
Travers Snyman	MSc Eng (Elec)	15
Steve Mahoney	BSc (Computer Science)	14

Table 2 Management Team

The remainder of the R & D team:

Name	Qualification	Years Experience
John Longland	B.Eng Pr.Eng	15
Kenny Kan	Mech. Eng	7
Jan Coetzer	M.Dip Tech	11
Hendrik van Niekerk	BSc	13
Elna Monte	Developer	15
Johan Vosloo	B. Computer Science	12

Table 3 Additional R&D Resources

10 Timeline for Program Implementation

It is estimated that for meaningful conclusions, the study trial will need to run for at least a nine month to one year period. The first stage of the study will be for evaluating of various areas as to suitability of the IMTF solution.

11 Benefits of IMTF Solution

11.1 Summary of Benefits

a) Present day issues resolved with IMTF Solution

Consumers side

- Untimely Blackouts - resolved
- Poor Analysis of Consumption - resolved
- No Discount Options - resolved
- Fixed Billing Tariffs - resolved.
- No Feedback - resolved.
- Poor Outage Identification - resolved
- Poor Conservation Assistance - resolved
- No feedback and general lack of information - resolved
- Often inaccurate billing - resolved

Distributor side

- Unable to Influence Consumer Load Patterns - resolved
- No TOU Metering - resolved
- Poor Load Management - resolved
- Lack of real time system data - resolved
- Poor Tamper Detection - resolved
- Cumbersome Energy & Financial Reconciliation - resolved
  Require Additional Revenue Streams - resolved

b) Philosophy of IMTF Solution

- ✓ INFORMED DECISIONS
  Consumers with access to current information, enables the utility to influence consumptions behaviour.

- ✓ SMART LOAD MANAGEMENT
  Reconfigurable Load Groups based on Season, Day of Week and Time of Day.
- ✓ CONSERVATION
  Defer capital expenditure with improved utilization of existing infrastructure.
- ✓ IMPROVED CASH FLOW
  Reduced “Read to Bill” time. Prepayment for consumption, etc.
- ✓ IMPROVE LEVEL OF SERVICE
  Provide mechanism to effectively manage energy usage while increase communication between utilities and consumers.

11.2 Unique services provided by IMTF Solution.

- ✓ Summation metering at power distribution points.
- ✓ Remote connection / disconnection of consumers.
- ✓ Remote tamper detection.
- ✓ Prepayment or credit / billing methods of Revenue Collection.
- ✓ Remote Metering of electricity, water & gas.
- ✓ Smart Load control per consumer via remote connect/disconnect of non essential loads.
- ✓ Remote update of tariffs.
- ✓ Outage Detection
- ✓ Time Of Use (TOU) or multi-tariff metering
- ✓ Provide for additional revenue streams